

SCIENCE AND TECHNOLOGY BENEFIT ANALYSIS

Idaho Operations Office – Idaho National Engineering and Environmental Laboratory
Bechtel BWXT Idaho LLC

HEATED GAS GENERATION TEST SYSTEM

The Heated Gas Generation Test System (HGGTS) provides the INEEL Transuranic Waste Program with the ability to heat and collect gas samples from previously non-certifiable Test Category IV Contact Handled Transuranic (CH-TRU) waste streams. Test Category IV wastes are waste streams composed of CH-TRU, organic setups, solidified organics, and special setups. Analysis of characterization data on this class of waste indicated that a technically defensible system did not exist to adequately perform gas generation sampling in accordance with the TRUPACT-II Safety Analysis Report for Packaging (SARP). These wastes and their compositions presented INEEL engineers and management staff with both a technical and non-compliance challenge. The challenge was met with additional research to better understand INEEL's technical and scientific needs and recommend modifications to the existing Gas Generation Test System (GGTS).

Significant efforts followed and included modeling, scale-up from laboratory work, safety evaluations, and engineering evaluations as described in an external report (white paper)^a. Scientists and engineers studied lab-sample to drum-scale interpretations, evaluated safety for drum gas generation testing, and provided recommendations for testing these wastes and addressed the safety concerns for meeting the TRUPACT-II Safety Analysis Report for Packaging.






This Analysis resulted in the Heated Gas Generation Test System (HGGTS) with improvements to the sampling gas collection system and enabled the 3100m³ project to meet TRUPACT-II SARP criteria. This system was deployed on June 18, 2001 for the INEEL Transuranic Waste Program at the Stored Waste Examination Pilot Plant (SWEPP).

Heating canisters to elevated temperatures (146 °F) prior to sampling for total gas and hydrogen (H₂) generation ensures safety concerns over flammability are satisfied. Additionally, the new HGGTS corrects problems in the earlier gas generation test collection system by incorporating a closed system that reduces flow instabilities in low flow conditions and minimizes system pressure fluctuations. The technology enables the certification of 1,693 sludge drums previously not shippable to WIPP. This deployment by the Transuranic Waste Program (PBS-WM-103) helps meet STCG need ID-3.1.33, "Develop In-Situ Hydrogen and Volatile Organic Compound (VOC) Reduction".

Qualitative Benefit Analysis

Programmatic Risk	●	The INEEL would not have been able to meet the TRUPACT-II SARP criteria for shipping specific categories of CH-TRU waste to WIPP if the heating system were not in place. The heating system allows gas measurements at the elevated temperature required for the test category waste streams. Therefore, the HGGTS helps enable the objectives of the 3100m ³ project, a court agreement with the State of Idaho.
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^a Connolly, M.J., and Djordjevic, S.M., Flammable Gas Evaluation of Idaho National Engineering and Environmental Laboratory IDC 003 Organic Setup Sludge and 55-Gallon Drum Gas Generation Testing, INEEL/EXT-01-00448, Rev. 1, March 2001.

Technical Adequacy	●	The Heated Gas Generation Test System (HGGTS) improves the previous GGTS by utilizing heated canisters and a closed sampling system, which resolves safety issues and improves flow and pressure fluctuations. The HGGTS also enables testing of the test category waste streams whereas the GGTS was inadequate for testing these waste streams due to having a heat source.
Safety	●	Heating canisters resolves flammability concerns of test category waste and ensures that the 3100m ³ project complies with the TRUPACT-II Safety Analysis Report for Packaging (SARP).
Schedule Impact	◐	Project schedules are expected to be more flexible as the deployed system will allow meeting the TRUPACT-II SARP criteria for test category waste streams. The number of analytical category waste streams requiring GGT is less if the TRUPACT-II Authorized Methods for Payload Control (TRAMPAC) Revision 19 is approved. However, the amount of test category waste streams requiring HGGT remains at 1,693 drums regardless of the approval of TRAMPAC Rev. 19. Therefore, if TRAMPAC Rev. 19 is implemented, the HGGTS can be available for processing test category drums instead of other drums thus helping the schedule.
<div>      </div> <div> Major improvement Some improvement No change Somewhat worse Major Decline </div>		
Quantitative Benefit Analysis		
Cost Impact Analysis		The electric heating and gas collection system is an enabling technology. Therefore, there is no specific quantitative cost analysis and cost basis provided. However, this deployment allows certifying 1,693 drums ^b that were not certifiable prior to this deployment. The certification of the test category waste streams supports the objectives of the 3100 m ³ project. Additionally, cost avoidance is achieved by avoiding capital investments and negative aspects of not meeting the Settlement Agreement milestones.

^b Van Haaften, D.H., Barnard, C.J., Available Inventory for SWEPP Processing for the 3,000-m³ Project, INEEL Internal design file, EDF-1402, Rev. 1, September 19, 2000.

HEATED GAS GENERATION TEST SYSTEM

Worksheet 1: Operating & Maintenance Annual Recurring Costs

Expense Cost Items *	Before (B) Annual Costs	After (A) Annual Costs
1. Equipment	\$ -	\$ -
2. Purchased Raw Materials and Supplies	\$ -	\$ -
3. Process Operation Costs:		
Utility Costs	\$ -	\$ -
Labor Costs	\$ -	\$ -
Routine Maintenance Costs for Processes	\$ -	\$ -
Subtotal	\$ -	\$ -
4. PPE and Related Health/Safety/Supply Costs	\$ -	\$ -
5. Waste Management Costs:		
Waste Container Costs	\$ -	\$ -
Treatment/Storage/Disposal Costs	\$ -	\$ -
Inspection/Compliance Costs	\$ -	\$ -
Subtotal	\$ -	\$ -
6. Recycling Costs		
Material Collection/Separation/Preparation Costs:		
a) Material and Supply Costs	\$ -	\$ -
b) Operations and Maintenance Labor Costs	\$ -	\$ -
Vendor Costs for Recycling	\$ -	\$ -
Subtotal	\$ -	\$ -
7. Administrative/other Costs	\$ -	\$ -
Total Annual Cost:	\$ -	\$ -

* See attached Supporting Data and Calculations.

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Worksheet 2: Itemized Project Funding Requirements* (i.e., One Time Implementation Costs)

Category	Cost \$
INITIAL CAPITAL INVESTMENT	
1. Design	\$87,425
2. Purchase	\$0
3. Installation	\$555,702
4. Other Capital Investment (explain)	
Subtotal: Capital Investment= (C)	\$643,127
INSTALLATION OPERATING EXPENSES	
1. Planning/Procedure Development	\$119,715
2. Training	\$0
3. Miscellaneous Supplies	\$0
4. Startup/testing	\$0
5. Readiness Reviews/Management Assessment/Administrative Costs	\$31,463
6. Other Installation Operating Expenses (explain)	\$0
Subtotal: Installation Operating Expense = (E)	\$151,178
7. All company adders (G & A/PHMC Fee, MPR, GFS, Overhead, taxes, etc.)(if not contained in above items)	\$ -
Total Project Funding Requirements=(C + E)	\$794,305
Useful Project Life = (L) 0 Years Time to Implem 0 Months	
Estimated Project Termination/Disassembly Cost (if applicable) = (D)	\$ -
(Only for Projects where L<5 years; D=0 if L>5 years)	
TOTAL LIFE-CYCLE COST SAVINGS CALCULATION FOR IPABS-IS	
(Before - After) x (Useful Life) - (Total Project Funding Requirements + Termination)	
Total Life Cycle Cost Savings Estimate = (B - A) x L - (C+E+D)	
RETURN ON INVESTMENT CALCULATION	
Return on Investment (ROI) % =	
$\frac{(Before - After) - [(Total Project Funding Requirements + Termination)/Useful Life]}{[Total Project Funding Requirements + Project Termination]} \times 100$	
$ROI = \frac{(B-A)-[(C+E+D)/L]}{(C+E+D)} \times 100 \text{ ##### \%}$	
O&M Annual Recurring Costs:	Project Funding Requirements:

HEATED GAS GENERATION TEST SYSTEM

GENERAL

Deployment of the HGGTS Canister system is only one component of an integrated testing system that tests the waste streams to be shipped to the WIPP for disposal. The deployment also has incorporated a closed gas collection system. The use of the Heated GGTS system allows the INEEL to evaluate test category IV waste streams for shipment to the WIPP. It also establishes methodology to meet commitments INEEL has, with the State of Idaho, for the shipment of the 3100m³ of TRU waste to WIPP. Currently the system will be testing test category IV waste streams containing organic setups, solidified organics, and special setups. The purpose of the heated testing is to ensure flammability limits are not exceeded for test category wastes that exceed applicable decay heat limits or do not have an established theoretical bounding gas generation rate.

INITIAL CAPITAL INVESTMENT

The initial capital investment was funded by EM-40. The total amount of \$794K reflects the cost to design, install and prepare the Heated GGTS for operation.

INSTALLATION AND START-UP

The installation and startup costs are the actual values for the HGGTS deployment prior to the start of operations.

TRADITIONAL (BASELINE) TECHNOLOGY/METHOD

The prior GGTS had no heating capability. It was an open system, i.e., the gas was measured as it was generated. The open system GGTS was evaluated and determined to be inadequate in obtaining the data required to determine the gas generation rates. The shortcomings of the open GGTS included fluctuations in gas-flow (from the open test canisters with changes in pressure differential) as well as difficulty in measuring low gas-flow rates and low H₂ concentrations in the canister. The current closed system corrects the problems of that prior system as well as providing a heating system so that test category wastes can be tested in addition to the other waste streams requiring testing.

NEW TECHNOLOGY/METHOD

The new, closed system HGGTS consists of test canisters that capture gases released from vented waste drums and gas analysis equipment to determine the gas composition in the canister. The HGGTS has the capability of heating canisters to elevated temperatures (146 °F) prior to sampling for total gas and hydrogen (H₂) generation thus ensuring safety concerns over flammability are satisfied. The new HGGTS corrects problems in the earlier gas generation test collection system by incorporating a closed system that reduces flow instabilities in low flow conditions and minimizes system pressure fluctuations. The INEEL is the only DOE facility with the heating capability.

COST SAVINGS/COST AVOIDANCE/RISK REDUCTION

The use of this system will help the INEEL meet their objectives of the 3100m³ project of shipping waste to WIPP by CY 2003. This is a court agreement with the State of Idaho and will be used to meet the commitment with the state so that the INEEL will not incur fines. The INEEL is using it for a new application, IDC 003, organic setups, in addition to the other codes. The shipment of the test category IV waste streams means that the INEEL will not have to incur the costs of retrieving drums in other categories.


**SCIENCE AND TECHNOLOGY BENEFIT ANALYSIS
DEPLOYMENT APPROVALS**

Technology Deployed: HEATED GAS GENERATION TEST SYSTEM


Date Deployed: June 18, 2001

EM Program(s) Impacted: Transuranic Waste Program

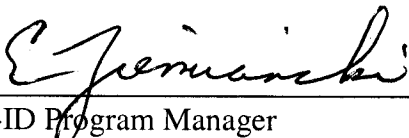
Approval Signatures




Contractor Program Manager 9-11-01
Date



Contractor Program Manager Date



DOE-ID Program Manager 9-12-01
Date



DOE-ID Program Manager Date